Meng Li (http://meng.rice.edu/)

Contents [hide]

1 STAT 625: Advanced Bayesian Inference
- 1.1 Course Description
- 1.2 Prerequisites
- 1.3 Textbooks
- 1.4 Computing
- 1.5 Grade Policies
- 1.6 Late Policy
- 1.7 Rice Honor Code
- 1.8 Disability Support Services

STAT 625: Advanced Bayesian Inference

Instructor:	Meng Li	Office:	Duncan Hall 2081
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Lectures:	Tuesday/Thursday, 10:50AM-12:05PM	Location:	AEL A121

Syllabus (http://meng.rice.edu/teaching/stat625)	**Schedule (http://meng.rice.edu/schedule-stat625)**	**Resource**

Course Description

This course focuses on the Bayesian inferential methods with emphasis on theory and applications. The recent developments of computational tools have brought Bayesian treatment of complex problems within the reach of practicing statisticians. Substantial progress has been made in developing a theory for infinite dimensional models and toward the implementation of the Bayesian computational methods for variable dimensional models. This course will illustrate a variety of theoretical and computational methods, simulation techniques, and hierarchical models suitable for analyzing complex data. Broad topics include advanced Monte Carlo methods, asymptotic theories, adaptive methods, and Bayes nonparametrics.

Heres is a tentaitve course outline with weight in parathenses:

- **Methods** (1/2) : nonparametric Bayes such as Gaussian process, Dirichlet process, Chinese restaurant process, Mixture models, Introduction to asymptotic theory, and variable selection

- **Computation** (1/3) : advanced MCMC such as sequential Monte Carlo, variational methods, convergence assessment, approximation method, and statistical efficiency.
- **Application** (1/6) : selected areas such as machine learning, structrual biology, biomedical research (such as brain connectome, neuroimaging), etc.

Prerequisites

STAT525 or equivalent courses on Bayesian inference. We will assume familiarity with basics of Bayesian inference: prior and posterior distributions, Bayesian linear regression, conjugate families, logistic regression, Gibbs sampling.

Textbooks

There is no course text. Outside readings will be assigned.

General references:

- Ghosal, S. and van der Vaart, A. (2017). Fundamentals of Nonparametric Bayesian Inference. Cambridge University Press.
- Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2014). Bayesian Data Analysis (Third Edition). Boca Raton, FL: CRC press.
- Rasmussen, C.E. and Williams, C.K.(2006). Gaussian Processes for Machine Learning. Cambridge: MIT press.
- Robert, C. and Casella, G. (2004). Monte Carlo Statistical Methods. Springer, New York

Computing

This course will have an applied emphasis. You will be expected to implment introduced methods to analyze real or simulated data. We do not focus on specific software or packages.

Grade Policies

- Homework and Class participation (30%): Reading materials and problem sets will be assigned regularly over the course of the term.
- Midterm (30%): An in-class examination (closed-book) will be given on Thursday 2/22.
- Final Project (40%): You will complete a project in the second half of the course with writing up (20%) and presentation (20%).

Late Policy

Students may not request extensions, instead, we have the following policies in case something unexpected arises:

- Your lowest assignment grade will be dropped.
- Late homework will be accepted within five days of the due date with a 10-percentage point deduction per day (including weekends).

Rice Honor Code

In this course, all students will be held to the standards of the Rice Honor Code, a code that you pledged to honor when you matriculated at this institution. If you are unfamiliar with the details of this code and how it is administered, you should consult the Honor System Handbook at http://honor.rice.edu/honor-system-handbook/. (http://honor.rice.edu/honor-system-handbook/.) This handbook outlines the University's expectations for the integrity of your academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process.

Disability Support Services

If you have a documented disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with Disability Support Services (Allen Center, Room 111 / / x5841) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

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